NRL Translation 1257
13 November 1972

ON THE QUESTION OF CURRENT DYNAMICS IN THE NORWEGIAN AND GREENLAND SEAS

(K voprosu o dinamike techeniy v Norvezhskom i Grenlandskom moryakh)

by V.V. Penin

Translated from: Materialy rybokhozyaystvennykh issledovaniy Severnogo basseyna (Materials on marine fisheries research in the northern basin), Vol. 5 (1965), pp. 80-90.

A complete translation from the Russian, by Richard S. Relac

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16

ON THE QUESTION OF CURRENT DYNAMICS IN THE NORWEGIAN AND GREENLAND SEAS (*)

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The pattern of the permanent currents of the Norwegian and Greenland Seas, adopted by the Polar Institute is that of Alekseyev and Istoshin, which they revised in 1957 [1].

The chart of relative topography for the 0-500 dbar layer in the Norwegian Sea constructed by the dynamic method from the results of the June, 1963 survey [2], as well as the above-mentioned pattern, clearly shows the entire Norwegian current system and the East Icelandic current, which enters the Faeroe-Shetland channel from 64°N along the 3°W meridian.

Moreover, the dynamic chart shown here, as well as the scheme published by Helland-Hansen and Nansen [3] shows a cyclonic motion of the water masses, but its center is situated more to the West. The crowding of the dynamic contour lines clearly reveals the zone where the western branch and its northwestern arm converge with the East Icelandic current.

North of the Faeroe Islands is the zone where the East Icelandic current converges with the Faeroe branch of the North Atlantic current. North of 67°30'N, between 2° and 8°E, we observe a circular motion of the Atlantic waters and their sinking to great depths.

The structure of the currents in the Norwegian Sea is strongly influenced by the bottom topography [4]. The center of the aforementioned cyclonic gyre in the western part of the Norwegian Sea is located over a rise with a depth of 975 m, situated between the Icelandic and Norwegian depressions.

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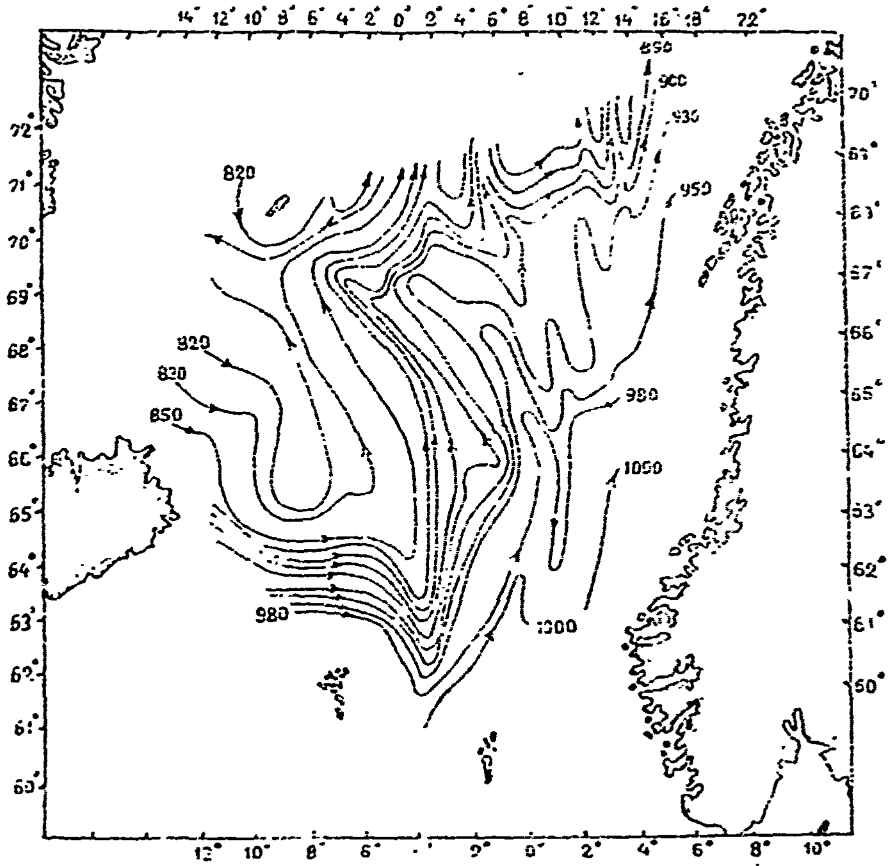

Fig. 1. Dynamic chart of the Norwegian Sea.

The sinking of Atlantic waters north of 67°30'N is related to a depression of the sea floor. There is a morphological boundary here between the Norwegian plateau and the Lofoten Basin.

Northeast of Iceland, the East Icelandic current passes through a trough, bordered by an isobath of 1000 m on the southeast and a bank with a depth of 975 m on the northeast (68°30'N and 7°40'W). In the southern part of the Norwegian Sea, the deep waters of the East Icelandic current fan out in two directions. One branch tends to the East, flowing along the southern border of the Norwegian Basin, while the other enters the Faeroe-Shetland channel through a deep trough.

In the region of the Mohns Ridge, the warm Atlantic waters are wedged in over the deep depressions, and the tongues of cold water from the Jan Mayen branch of the East Greenland current are positioned over the rises between them.

STRUCTURE AND STABILITY OF THE CURRENT SYSTEM IN THE NORWEGIAN AND GREENLAND SEAS

The next step in our investigation was a detailed analysis of the dynamic structure of the waters of the Norwegian and Greenland Seas along standard profiles, and a determination of the stability of the East Icelandic and branches of the Norwegian currents during different months of individual years.

On the profile along 63°N, the East Icelandic current was located at exactly the same coordinates (4°W-3°30'W) in June of 1960, 1962 and 1963, and had the following maximum velocities: 13.9 cm/sec, 8.2 cm/sec and 24.4 cm/sec, respectively.

As may be seen from Table 1, in June of 1963, when the water temperature of the East Icelandic current was the lowest it had been over the last five years, the cold stream covered a larger area than in 1960 and 1962, extending from 4°45'W to 3°30'W.

Table 1. Current velocities at 63°N in June of 1960, 1962 and 1963 (cm/sec):

	Depth, m	Coordinates (West)						
		6° 30'— 5° 30'	5° 30'— 4° 45'	4° 45'— 4° 00'	4° 00'— 3° 30'	3° 30'— 2° 30'	2° 30'— 1° 50'	1° 50'— 1° 00'
	0	—0,3	+23,1	+26,3	—13,9	+8,2	—15,5	+13,2
	20	—0,3	+23,1	+26,3	—13,7	+7,4	—15,3	+13,2
1960	50	—0,3	+23,1	+25,5	—12,0	+7,4	—14,7	+13,2
	100	—0,3	+22,8	+22,4	— 8,4	+5,2	—13,1	+13,2
	200	—0,1	+19,5	+15,3	— 4,3	+3,2	— 9,4	+11,3
	0	+3,6	+ 3,9	+ 3,4	— 8,2	+4,4	+ 1,0	+ 3,6
	20	+3,6	+ 3,6	+ 3,4	— 8,2	+4,2	+ 1,3	+ 3,1
1962	50	+3,6	+ 3,6	+ 3,6	— 8,2	+3,9	+ 1,4	+ 3,1
	100	+3,6	+ 3,6	+ 3,6	— 8,2	+3,9	+ 1,0	+ 3,4
	200	+3,2	+ 3,3	+ 3,1	— 7,2	+3,3	— 0,3	+ 3,4
	0	—4,6	+ 3,4	— 6,6	—24,4	+2,8	+17,0	— 1,6
	20	—4,5	+ 3,2	— 6,6	—23,9	+2,7	+16,4	— 1,4
1963	50	—4,2	+ 3,2	— 7,0	—22,9	+2,6	+15,5	— 1,4
	100	—4,2	+ 3,4	— 7,0	—22,0	+1,6	+14,5	— 1,6
	200	—4,2	+ 3,8	— 7,0	—11,2	+0,2	+10,1	— 1,0

NOTE: For Tables 1-12, a (+) sign indicates northward motion, a (-) sign indicates southward motion, and commas within numbers represent decimal points.

In 1963, as in 1970, a branch of the East Icelandic current was observed on the 63°N profile. In June of 1963 it was located between 1°50'W and 1°W. . It was not present in 1962, since the velocity of the main cold stream was low (approximately 8.2 cm/sec).

The greatest combined extent of the East Icelandic current and its branch was recorded in March 1963 (Table 2) The main stream was located between 4°30'W and 2°30'W, and its branch was located between 1°40'W and the zero meridian.

Table 2. Current velocities at 63°N in March 1963 (cm/sec):

Depth, m	Coordinates (West)								
	6° 30'— 5° 30'	5° 30'— 4° 27'	4° 27'— 3° 55'	3° 55'— 3° 29'	3° 29'— 2° 29'	2° 29'— 1° 40'	1° 40'— 1° 00'	1° 00'— 0° 00'	0°— 0° 45'
0	—5,0	+4,8	—2,6	—1,4	—2,8	+11,2	—7,5	—5,4	+20,2
20	—4,6	+5,0	—2,6	—1,4	—2,8	+11,2	—7,3	—5,2	+19,6
50	—4,5	+5,1	—2,6	—1,4	—2,8	+11,1	—7,0	—5,2	+19,4
100	—4,4	+5,4	—2,6	—1,4	—2,6	+10,6	—7,0	—4,8	+18,4
200	—2,4	+3,9	—2,4	—1,0	—1,5	+ 8,4	—6,6	—3,0	+14,8

In the years with a noticeable strengthening in the East Icelandic current, the Norway current at 63°N seems to be divided into two streams. Thus, in 1960 and 1963, a warm flow was traced between the East Icelandic current and its branch. When the Norway current was found to be strong at this latitude, its core was held at a longitude of 0°45'E, and when it weakened, it was displaced to the East, being situated at 1°30'E.

The significant seasonal fluctuation of the Norway current is attested to by the fact that in March of 1963 its velocity was 20.2 cm/sec, while in June of the same year it was 8.4 cm/sec (the summer minimum).

On the 63°N profile, one may note an inverse relationship between the average temperatures of the 0-200 m layer in the Norwegian current and the 0-200 and 200-500 m layers in the East Icelandic current over the last five years (Table 3).

Table 3. Average temperatures of the 0-200 m layer in the Norwegian current and the 0-200 and 200-500 m layers in the East Icelandic current (June 1954-1963):

Current	Layer, m	Year				
		1959	1960	1961	1962	1963
Norway	0—200	8,34	8,85	8,54	7,78	8,26
East	0—200	7,06	6,10	7,57	7,92	6,20
Icelandic	200—500	3,67	1,49	3,43	4,31	2,40

On the profile at 65°45'N, the axis of the cold East Icelandic current, as shown by the dynamic calculations, is located in most cases between 9° and 10°W. The velocity of water transport by the East Icelandic current in the summer of 1963 was also higher on this profile than during the same period in 1960 (Table 4), which caused great negative temperature anomalies here in the surface and deep layers.

Table 4. Current velocities at 65°45'N in July 1960 and June 1963 from 11°W to 3°10'W (cm/sec):

Year	Depth, m	Coordinates (West)							
		11°—10°	10°—9°	9°—8°	8°—7°	7°—6°	6°—5°	5°—4°	4°—3°10'
1960	0	+1,4	−2,9	−1,0	−3,7	+5,1	+1,5	−2,7	+5,3
	20	+1,0	−2,9	−1,2	−3,4	+4,6	+1,7	−3,2	+5,5
	50	+1,2	−3,2	−1,2	−2,6	+3,7	+2,0	−3,7	+5,7
	100	+0,7	−2,7	−1,0	−1,7	+3,6	+1,7	−3,6	+5,1
	200	−0,8	−1,4	−0,7	−0,3	+2,9	+1,4	−3,6	+3,1
1963	0	−1,9	−4,2	+0,3	−0,2	+3,2	−0,3	+2,2	0,7
	20	−2,0	−4,1	+0,5	−0,2	+3,4	−0,8	+1,9	+0,9
	50	−1,9	−4,1	+0,8	−0,3	+3,7	−1,2	+1,4	+0,9
	100	−1,7	−3,7	+1,2	−0,3	+3,7	−0,8	+0,5	+0,9
	200	−0,7	−3,2	+1,0	+0,3	+3,1	−0,7	−0,3	+1,3

The lateral extent of waters of the East Icelandic current does not remain constant; it varies in direct proportion to fluctuations in current speed. For example, in July 1960 and June 1963, its boundaries were between 10° and 7°W and between 12° and 9°W respectively, but in October of 1960 the boundaries were between 11° and 10°W.

In the years of a strong East Icelandic current (1960 and 1963), its branch between 6° and 5°W on the 65°45'N profile was traced at maximum velocities in the 50-200 m layer. In the years of relatively weak circulation (1961 and 1962), this branch was also weaker.

In the summer months of 1960 and 1963, the warm waters of the western branch of the Norway current on the same profile occupied a large area. Their western boundary ran along 3°10'W, and the eastern boundary ran between zero and 1°W (Table 5).

The core of the western branch, which extended between 0 and 1°W in June of 1960, was significantly displaced to the east in June of 1963, apparently under the influence of the strengthening East Icelandic current.

The velocity of the western branch was lower in 1963 than in 1960, and the average temperature of its 0-200 m layer was 0.97° lower.

Table 5. Current velocities at 65°45'N from 3°10'W to 6°E in July 1960 and June 1963 (cm/sec):

Year	Depth, m	Coordinates (West)				Coordinates (East)						
		3°10'—2°30'	2°30'—1°45'	1°45'—1°00'	1°00'—0°	0°—1°	1°—2°	2°—2°40'	2°40'—3°30'	3°30'—4°15'	4°15'—5°	5°—6°
1960	0	+0,7	+5,3	+3,6	—10,5	+13,8	+8,2	— 0,9	—5,6	+24,0	—2,2	—
	20	+0,7	+4,8	+3,6	—10,4	+13,5	+7,8	— 0,4	—6,1	+22,2	—1,8	—
	50	+0,2	+4,4	+3,4	— 9,4	+12,8	+6,9	+ 0,4	—6,1	+20,0	—1,2	—
	100	+0,2	+3,7	+2,7	— 7,6	+10,9	+7,1	0	—5,0	+17,2	—0,7	—
1963	0	+3,2	+2,6	+0,2	+ 3,4	— 1,2	+2,7	+12,8	+4,4	— 5,7	+5,7	+2,9
	20	+3,2	+3,1	+0,4	+ 3,2	— 1,4	+2,4	+12,8	+4,4	— 5,6	+5,6	+2,7
	50	+2,5	+1,5	+0,4	+ 3,2	— 1,7	+2,2	+12,8	+4,4	— 5,3	+5,3	+2,6
	100	+1,8	+0,9	0,0	+ 3,2	— 1,9	+1,9	+12,6	+4,3	— 5,4	+4,4	+2,2

Moreover, in June 1963 the western branch was more intense than the eastern branch, as a result of which the temperature of its 0-200-m layer was about the same level as 1961, a warm year, while at the same time the eastern branch was colder than in 1961.

In the summer of 1960, the velocity of the eastern branch of the Norway current was significantly higher than in 1963, which also agrees well with the temperature conditions.

During the years when the East Icelandic current was strong (1960 and 1963), the 65°45'N profile showed the boundary between Atlantic and polar waters located along 1°45'W, but in 1962, when the current was weak, it was shifted to 3°10'W.

On the 67°30'N profile, the axis of the western branch was located in the majority of cases between 1° and 2°W (Table 6).

Table 6. Position of the axis of the western branch on the profile at 67°30'N:

Longitude	Months in 1960					Months in 1963		
	Jan.	Apr.	June	August	Sept.	June	July	Aug.
East:	2°—2°40'	1°—2°	0°—1°	2°—2°40'	1°—2	1°—2	1°—2	1—2°

The velocities of the western branch on this profile were lower in June of 1963 than the same period in 1960 (Table 7). Its temperatures varied in direct proportion to the current velocity.

Table 7. Current velocities at 67°30'N in June of 1960 and 1963 (cm/sec):

Year	Depth, m	Coordinates (East)					
		1°–0°	0°–1°	1°–2°	2°–2°40'	2°40'–3°30'	3°30'–4°15'
1960	0	+4,2	+9,2	+0,5	–1,2	– 6,5	+5.8
	20	4,1	+9,2	+0,6	–1,2	– 6,5	+5.8
	50	+3,9	+9,0	+0,5	–1,0	– 6,3	+5,6
1963	0	+2,4	+0,4	+7,0	+3,6	–10,1	0
	20	+2,2	–0,2	+7.4	+3,1	– 9.6	–0.2
	50	+2,4	–0.4	+7,2	+2,6	– 8,9	–0,5

The rate of increase in velocity, and consequently the heat transport, was higher in the western branch than in the eastern branch on the 67°30'N profile in June 1963. Thus, the variation in the average temperatures of the 0-200 m layer in the eastern branch (+T = June 1963, -T = June 1960), was -0.56°, while in the western branch it was -0.06°.

In July 1963, the velocity of the western branch grew to 13.5 cm/sec along the core, as opposed to 7 cm/sec in June of the same year. In August, however, the influx of heat decreased somewhat, which caused a decrease in the average temperature of the deep 200-500 m layer.

Table 8. Current velocities at 67°30'N in July and Ausust 1963 (cm/sec):

Month	Depth, m	Coordinates (East)				
		1°–0°	0°–1°	1°–2°	2°–2°40'	2°40'–3°30'
July	0	–1,3	+1,8	+13,5	–3,4	–3,1
	20	–1,1	+1,7	+13.1	–2,9	–3,4
	50	–1,0	+1,5	+13,0	–2,6	–3,4
August	0	–0,2	–3,6	+11,3	+6,2	+0,2
	20	+0,2	–3,8	+11,0	+6,0	0,0
	50	+0,7	–4,0	+10,6	+5,5	–0,2

The axis of the eastern branch of the Norway current underwent insignificant shifts, remaining between 6°45'W and 7°30'W.

Our attention was drawn to a well-developed stream between the eastern and western branches of the Norway current. Its direction is opposite to that of the main currents. Evidently, there is a circular motion of the waters here.

On the 67°30'N profile, the position of the polar front also varied with the velocities of the East Icelandic current and the western branch of the Norway current. The dividing line between the polar and Atlantic waters ran along 5°W in the summer and fall months of 1960 and 1963, but in 1961, when the circulation of the East Icelandic current was somewhat weaker, this line was shifted westward to 7°W.

In the northern part of the Norwegian Sea, on the 68°20'N profile, the northwest arm of the Norway current is located between 7° and 5°W. The border of its maximum eastern position may be assumed to be 4°W.

Judging by the rate of increase in the velocities of the northwest arm and the eastern branch in June 1963, we may conclude that the advection of heat by the northwest arm in this year was greater than that of the eastern branch. The variation in the average temperatures of the 0-200 and 200-500 m layers of the northwest arm for the two comparable years (+T = 1963, -T = 1960) was +0.3° and +0.6°, while for the eastern branch these differences were -0.88° and -1.02°, respectively. It should be noted that the advection of heat by the eastern branch of the Norway current in June 1960 was the greatest it had been for the last ten years.

Table 9. Current velocities at 69°20'N in June and August 1963 (cm/sec):

Month	Depth, m	Coordinates (West)							
		8°—7°	7°—6°	6°—5°	5°—4°	4°—3°	3°—2°	2°—1°	1°—0°
June	0	—0,2	+3,6	+8,0	—2,2	—0,2	+5,6	+5,4	—5,4
	20	—0,2	+3,4	+7,4	—2,0	—0,2	+5,2	+5,2	—5,2
	50	—0,2	+3,4	+6,4	—2,0	—0,2	+5,0	+4,6	—4,4
August	0	—1,6	+8,2	+3,0	+6,2	—2,2	+5,4	—0,6	—6,0
	20	—2,0	+8,2	+2,6	+5,8	—2,4	+5,0	—0,4	—5,6
	50	—2,0	+8,0	+2,4	+5,6	—2,4	+5,0	—0,6	—4,8

The velocity of the northwest arm was three times higher in June 1963 than during the same period in 1960. A further increase in its intensity was observed in August 1963. The width of this arm also increased from 40 nautical miles in June to 60 nautical miles in August (Table 9).

As may be seen from Table 9, in June 1963 between 3° and 1°W, and in August 1963 between 3° and 2°W, another arm of the western branch was tracked, leading into the area of the Mohns Ridge. Between this and the northwest arm, a cyclonic motion of the water masses may be observed.

From June to August 1963, the axis of the western branch shifted from 4°E to 1°E. Correspondingly, the axis of the northwest arm was also shifted to the east.

The average monthly temperatures of the 0-200 m layer in the eastern branch and the northwest arm on the 69°20'N profile were all analogous; their maxima occurred in May, August and November, which bears witness to the single-phase nature of their variation.

Table 10. Differences in average temperature for the 0-200 and 200-500 m layers of the eastern and western branches on standard profiles:

Layer, m	North Coord.	T 1959 – T 1960* I	II	T 1960 – T 1961 I	II	T 1961 – T 1962 I	II	T 1962 – T 1963 I	II
0–200	67°30′	+0,34	+0,98	+0,50	+0,40	–1,10	–0,92	+0.08	+0,47
	69°20′	+0,70	+0,23	+0,20	+0,17	–1,48	–1,06	+0 40	+0.[illegible]
	71°10′	+0,14	+0,50	+0.16	–0,33	–1.40	–0 71	+0.36	+0,71
200–500	67°30′	+0.30	+1.45	+0.76	–0,50	–0,77	+0.57	–0.22	–0.35
	69°20′	+0.55	+0,59	+0.36	+0,34	–1,27	–0.94	–0.09	+0.38
	71°10′	–0,72	+0,51	+0.16	–0,84	–0,98	+0,25	–0,14	–0,46

* I - Average temperature of eastern branch
  II - Average temperature of western branch

A series of average temperatures of the 0-200 and 200-500 m layers of the eastern and western branches on profiles from 65°45'N to 74°30'N has been correlated for the summer periods of past years. For the 0-200 m layer, the correlation coefficient was 0.92. The equation for this relationship may be expressed as: $y_w = 0.97x_e - 0.20$. A more complex relationship was observed in the 200-500 m layer. The average temperatures along the 65°45'N profile, the variations of which were caused not only by the velocities of the Norway current but also by the influence of the East Icelandic current, were excluded from the statistical series in this layer. Its correlation coefficient was not very high (+0.71).

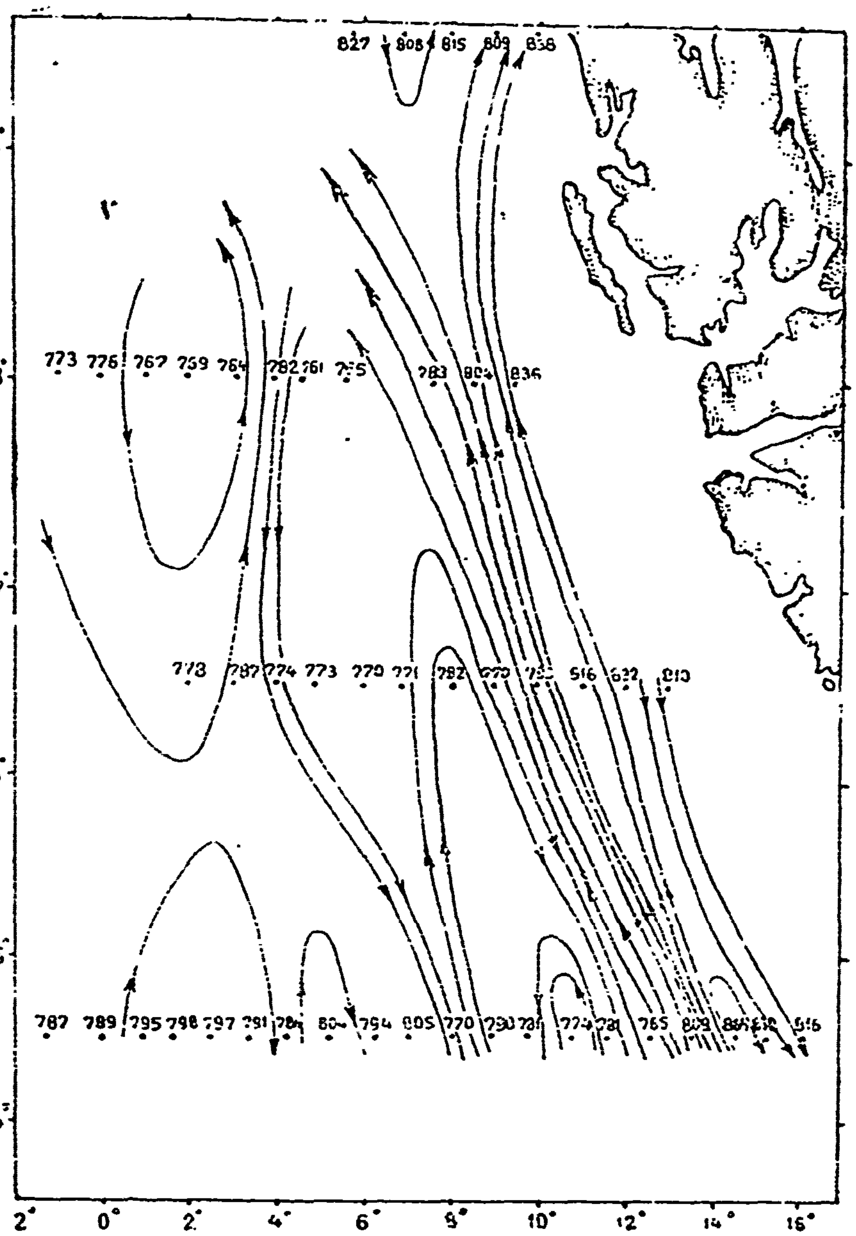

Fig. 2. Dynamic chart of the Greenland Sea.

On the profiles at 67°30'N, 69°20'N and 71°10'N, beginning with 1959, for each pair of years the temperature differences in the 0-200 and 200-500 m layers of the eastern and western branches were calculated separately (Table 10).

In the 0-200 m layer, the indicated differences have the same sign in all cases. In the 200-500 m layer, only the signs on the

69°20'N profile were the same. On the 67°30'N profile, the deep circulation of the western branch was subject to the strong influence of the East Icelandic current, which also caused the predominance of opposing signs. For the eastern branch, both the surface and deep circulation were characterized by an identical tendency to change.

The position of the branches of the Norway current in the Greenland Sea have been indicated on a dynamic chart of the Greenland Sea constructed from data of the June 1963 survey (Fig. 2).

On the profile at 74°30'N, the axis of the eastern branch passed between 13°30'E and 14°25'E, while the axis of the central branch was about 11°30'E.

The maximum velocities were found in the eastern branch. The velocity of the central branch of the Norway current on this profile during the same period was less than that of the western branch, which also caused the differing heat transport by these branches.

A merging of the central and eastern branches takes place on the 76°30'N profile. The combined flow, called the West Spitsbergen current, occupies a large area between 9° and 12°30'E. The western branch of the Norway current still remains independent, however, developing into a weak stream and turning into a gyre.

On the profile at 78°N, the West Spitsbergen current divides into two streams. One proceeds to the north, while the other turns to the northwest. Between them there appears a cyclonic gyre. According to dynamic calculations, the velocity of the West Spitsbergen current reached 19.5 cm/sec in June 1963.

ADVECTION OF HEAT BY THE NORWAY CURRENT AND ITS BRANCHES ON PROFILES FROM 63°N TO 71°10'N

In accordance with accepted practice [5], we calculated the advective transfer of heat as the difference in the quantity of heat transported through the two cross sections of the current (based on data from the June 1963 survey).

By using the dynamic method to process the data from all stations on the profiles, we obtained the current velocities in cm/sec for each level of observations. For determining the advection of heat, we took only those stations at which the direction of the current velocity coincided with the general direction of the current.

The formula for advective transfer of heat in cal/sec between neighboring profiles for each isobaric surface may be expressed in the

form:

$$A = \sum_{i=1}^{i=2} \bar{Q}_i \bar{V}_i l_i, \tag{1}$$

where $\bar{Q}_i$ and $\bar{V}_i$ are the weighted mean values of the temperature and velocity of the current at each profile (transverse to the current), and l_i is the corresponding length of the profile.

The weighted mean value of the temperature $\bar{Q}_i$ was determined from the formula:

$$\bar{Q}_i = \frac{1}{l_i} \int_0^{l_i} Q dl, \tag{2}$$

where Q is the mean value of the temperature at each standard level between two neighboring stations, and dl is the distance between stations.

The weighted mean value of the current velocity $\bar{V}_i$ on the profile was determined from an analogous formula:

$$\bar{V}_i = \frac{1}{l_i} \int_0^{l_i} V_i \, dl \tag{3}$$

The weighted mean values of the current velocity and temperature on the various profiles are indicated in Table 11.

The advective heat transfer between neighboring profiles was also calculated by E_q. (1) for each level of observations.

The maximum heat transfer (Table 12) was noted between the profiles at 6_°00' and 65°45'N, where the diffusion of Atlantic waters is still relatively small. Positive advection is observed over the entire three-hundred-meter layer. Farther to the north, between the profiles at 65°45'N and 67°30'N, there is a broadening of the geographic range of the Atlantic waters, which is accompanied by a decrease in the

amount of advective heat transfer. Furthermore, between these profiles the advection of heat attenuates very rapidly with depth, and at a depth of 300 m becomes negative. Such a phenomenon is explained by the influence of the deep East Icelandic current.

Table 11. Weighted mean current temperatures and velocities on the indicated profiles:

Depth, m	Coordinates (North)									
	63°		65° 45′		67° 30′		69° 20′		71° 10′	
	$\bar{Q}$	$\bar{V}$	$\bar{Q}$	$\bar{V}$	$\bar{Q}$	$\bar{V}$	$\bar{Q}$	$\bar{V}$	$\bar{Q}$	$\bar{V}$
0	9.89	5.8	8.57	3.6	8.77	3.3	7.34	3.7	5.93	4.0
20	9.12	5.4	7.40	3.5	7.73	3.3	7.09	3.5	5.66	3.9
50	8.44	5.2	6.37	3.2	6.61	3.2	6.07	3.1	4.76	3.7
100	7.24	4.9	5.19	2.9	5.83	3.0	5.37	2.7	4.29	3.2
200	5.77	3.9	4.08	2.2	5.04	2.3	4.73	1.8	3.79	2.3
300	4.50	2.6	3.12	1.2	4.31	1.6	4.29	1.1	3.40	1.4

Table 12. Amounts of advective heat transfer by branches of the Norway current (cal/sec):

Depth, m	Coordinates (North)			
	63° 00′—65° 45′	65° 45′—67° 30′	67° 30′—69° 20′	69° 20′—71° 10′
0	+2452	+1925	—2120	+1688
20	+2226	+1434	—2077	+1514
50	+2537	+ 963	—1298	+ 975
100	+2343	+ 427	— 823	+ 719
200	+1602	+ 79	— 280	+ 290
300	+1023	— 282	— 85	+ 177

The advection of heat falls off sharply between the profiles at 67°30'N and 69°20'N, where the Atlantic waters "spread out" over a wide area. The fall-off in heat advection was calculated separately for the eastern and western branches. For the western branch, the amount of heat advection was -591 cal/sec, while for the eastern branch it was -1550 cal/sec, i.e., the decrease in heat advection by the eastern branch was almost three times greater than that of the western branch.

A tendency for the eastern and western branches to draw closer is observed between the profiles at 69°20'N and 71°10'N: here, the amount of advection increases, becoming positive over the entire 300-meter layer.

CONCLUSIONS

1. The distribution of temperatures, salinity and current velocities on profiles in the Norwegian Sea indicates the existence of a complex system of eddy movements between the main branches of the Norway current.

2. The presence of gyres in the western part of the Norwegian Sea and between the eastern and western branches [of the Norway current] north of 67°30'N is undoubtedly related to the bottom topography.

3. During periods of a strong East Icelandic current, a branch of it separates and heads ESE.

4. The variations in mean temperatures of the 0-200 m layer in the western branch and the 0-200 and 200-500 m layers in the eastern branch had the same signs on all profiles, while the temperature variations in the 200-500 m layer of the western branch had differing signs on the profiles at 65°45'N and 69°20'N.

5. The advection of heat by the branches of the Norway current was minimal between 67°30'N and 69°20'N, and increased to the north and south of these profiles.

6. In certain cases, the advective heat transfer by the western branch is greater than by the eastern branch, which causes a disproportionate accumulation of heat by them and results in temperature anomalies in local areas of the sea.

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Translated October 1972 by R.S. Relac;
prepared for publication November 1972.

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